

California Regional Water Quality Control Board
Santa Ana Region

April 19, 2001

ITEM: 27

SUBJECT: Consideration of Beneficial Use Assessment Work Plan for Shellfish Harvesting in Newport Bay (Resolution No. 01-59)

BACKGROUND:

On April 9, 1999, the California Regional Water Quality Control Board, Santa Ana Region (Regional Board), adopted Resolution No. 99-10, which amended the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) to establish a Total Maximum Daily Load (TMDL) for fecal coliform in Newport Bay. A copy of the TMDL is attached to this report.

The objective of the fecal coliform TMDL is to address bacterial water quality problems in Newport Bay that adversely affect its beneficial uses, including water contact recreation (REC-1) and shellfish harvesting (SHEL). These problems are described in the attachment ("3. Bacterial Contamination", page 1-2). Briefly, due to consistently high levels of total coliform bacteria, the upper portion of Upper Newport Bay (Upper Bay) has been closed to these uses since 1974. In 1978, the shellfish harvesting prohibition area was expanded to include all of the Upper Bay, and the Orange County Health Care Agency (OCHCA) generally advises against the consumption of shellfish harvested anywhere in the Bay. The bacterial objectives specified in the Basin Plan to protect shellfish harvesting activities are rarely met in the Bay. These objectives are significantly more stringent than those established to protect water contact recreation. In general, there is good compliance with the water contact recreation objectives in the summer (dry weather). However, certain areas of the Upper and Lower Bay are closed to water contact recreation on a temporary basis in response to wet weather. The Basin Plan bacterial quality objectives for both SHEL and REC-1 protection are based on fecal coliform bacteria. (It may be noted that the OCHCA, which is responsible to post areas to warn against water contact recreation and shellfish harvesting, relies on a suite of bacterial indicators to assess public health risk (total coliform, fecal coliform, *E. coli*, and enterococcus), pursuant to AB 411).

Data collected by the OCHCA demonstrate that tributary inflows, composed of urban and agricultural runoff, including stormwater, are the principal sources of coliform input to the Bay. As expected, there are more violations of bacterial standards in the Bay during wet weather, when tributary flows are higher, than in dry weather. There are few data on the exact origin of the coliform in this runoff, but sources include manure (applied to agricultural crops and commercial and residential landscaping); fecal wastes from humans, household pets and wildlife; and food wastes from restaurants.

Table 5-9f shows the fecal coliform TMDL and the wasteload allocations and load allocations assigned to the identified sources. The TMDL is the density of fecal coliform organisms per volume of water. (It is the density of these organisms, and not their total number (or "load")

that is significant with respect to the protection of beneficial uses. Thus, the TMDL is based on density rather than load.) The densities established in the TMDL are

equivalent to the Basin Plan fecal coliform objectives for REC-1 and SHEL, with compliance to be achieved as soon as possible but no later than 2013 and 2019, respectively. As seen in Table 5-9f, a comparable approach is taken in specifying the wasteload and load allocations. The only exceptions are the allocations for vessel waste discharges. Wasteload allocations of zero are specified, reflecting the designation of Newport Bay as a "no discharge" harbor for vessel sanitary wastes.

Table 5-9g outlines an implementation plan leading to compliance with the TMDL and the REC-1 and SHEL water quality objectives. This plan requires that a series of tasks be implemented, resulting in the development of an updated TMDL report (Task 9). The fecal coliform TMDL requires that proposed plans be submitted to implement the tasks identified therein. It also specifies that the plans are to be implemented within specified time frames once the Regional Board approves the plans.

Orange County, the Cities within the watershed (Santa Ana, Costa Mesa, Newport Beach, Orange, Lake Forest and Tustin), The Irvine Company and agricultural operators in the watershed are responsible for fecal coliform discharges to Newport Bay. These parties are thus responsible to prepare the plans required by the TMDL and to implement them once approved by the Board. In accordance with the TMDL implementation plan (Table 5-9g, Task 3b), the County of Orange's Public Facilities & Resources Dept. (OCPF&RD) (on behalf of the Cities of Orange County) submitted a work plan for the Beneficial Use Assessment for Shellfish Harvesting in Newport Bay on March 1, 2001. A copy of this work plan is attached. The TMDL specifies that the assessment is to be completed within 13 months of Regional Board approval of the work plan.

Copies of the proposed work plan were distributed to interested parties. Comments on the proposal were requested by April 2, 2001. No comments were received as of April 4, 2001.

Board staff has reviewed this work plan and finds that it is generally acceptable. However, we have some remaining concerns and comments, which we have discussed with OCPF&RD staff. These comments/concerns, as described in an e-mail transmission to OCPF&RD, are summarized below.

Comments on Beneficial Use Assessment for Shellfish in Newport Bay

***Some bacterial testing should be conducted on typical shellfish samples since population size may not reflect high bacterial concentrations in the shellfish. This should be included as part of task 2 – resource survey, or included in task 4.1 with the water quality testing (depending on sites chosen for contaminant investigation). Samples of what appear to be healthy and unhealthy populations should be tested.*

Task 2 – Resource survey

***3 – Phase II – In reference to surveying "up to ten...shellfish beds... for limiting the number of sample beds to 10. If the number of shellfish beds found are high, then surveying 10 beds would be insufficient. The criteria for choosing sites for Phase II should also be specified.*

***4 – Phase II – As stated above, bacterial testing should be conducted on typical shellfish samples from both healthy and unhealthy populations. (This task may be included here or as part of task 4 as long as both types of populations are tested.)*

Sorting and collecting – If bivalves under 5mm are “missed”, how many does this generally include? and Does this method leave out certain species or immature bivalves of species that will otherwise be collected?

Task 3 – Beneficial Use Assessment – Shellfish Harvesting

Regarding the 2 week continuous monitoring period – it is unclear as to how many days monitoring will be conducted at each site. Also, during which season will the 2 week period occur in, and how will this 2 week period be chosen?

4 – Task 3.2 Design Exposure Data Collection Plan

Please include (in survey asking individuals whether they are harvesting shellfish for bait or consumption purposes), a question such as “Have you ever gotten sick after eating any shellfish taken from Newport Bay?” This may be useful information for future reference even though a health risk assessment is not planned for shellfish harvesting in Newport Bay.

Task 4 – Investigation of Beneficial Use Enhancement

Task 4.1 Screening Level Monitoring Investigation –

***1. Should include analysis of both water column and sediment samples. (This will be critical data for the assessment of substrate conditions.)*

2. Under “Sites to be monitored”, it seems that #2, 4 and 5 are the same – if these are different, please clarify the differences.

***3. Under “Sites to be monitored” – there appears to be three main types of sites possible –*

1. historical sites that no longer support shellfish populations, 2. sites with physical characteristics that appear to be able to support shellfish populations but do not, and 3. sites with unhealthy or sparse shellfish populations, or low diversity. However, a control site with healthy shellfish populations should also be analyzed for comparison.

***4. Under “Sites to be monitored” – The number of sites to be monitored should be based on the number of each site “type” found in tasks 1 and 2.*

Task 4.2 Pilot Scale Substrate Investigation

1. It would be prudent to have 2 study sites plus a control for quality control purposes.

Task 5 Final Report

Product – Please submit reports quarterly rather than semi-annually.

We expect that appropriate revisions to the work plan to address these concerns will be received prior to the Board meeting. If so, staff will recommend that the Board approve the work plan, as provided in Resolution No. 01-59.

OCPF&RD has requested that the schedule for completion of the shellfish harvesting beneficial use assessment be extended from 13 months to 24 months. Board staff agrees that this extension is reasonable and justified based on the comprehensive nature of the assessment proposed and the length of time that is realistically required to complete it.

RECOMMENDATION:

Adopt Resolution No. 01-59, approving the work plan for the Beneficial Use Assessment for Shellfish Harvesting in Newport Bay proposed by OCPF&RD, as revised to address Board staff concerns. Resolution No. 01-59 requires the completion of the assessment no later than April 1, 2003.

California Regional Water Quality Control Board
Santa Ana Region

RESOLUTION NO. 01- 59

Resolution Approving a Work Plan for a Beneficial Use Assessment for Shellfish
Harvesting in Newport Bay

WHEREAS, the California Regional Water Quality Control Board, Santa Ana Region (hereinafter Regional Board), finds that:

1. On April 9, 1999, the Regional Board adopted Resolution No. 99-10, which amended the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) to incorporate a Total Maximum Daily Load (TMDL) for fecal coliform in Newport Bay. The TMDL was subsequently approved by the State Water Resources Control Board, the Office of Administrative Law, and the U.S. Environmental Protection Agency.
2. The TMDL includes a fecal coliform implementation plan and schedule (Table 5-9g). This implementation plan requires the submittal of a proposed plan to conduct a shellfish harvesting beneficial use assessment in the Bay (Task 3 (b)). The TMDL requires that this plan be implemented within 13 months after Regional Board approval of the plan.
3. The County of Orange, the Cities of Irvine, Tustin, Newport Beach, Lake Forest, Santa Ana, Orange and Costa Mesa, The Irvine Company and agricultural operators in the watershed were identified as parties responsible for fecal coliform discharges to Newport Bay.
4. In a January 7, 2000 letter to the responsible parties, the Regional Board's Executive Officer requested the submittal of the shellfish harvesting beneficial use assessment plan and other plans required by the TMDL. This request was made pursuant to the authority provided by Water Code Section 13267.
5. On behalf of the responsible parties, the Orange County Public Facilities and Resources Department (OCPF&RD) submitted a "Beneficial Use Assessment for Shellfish Harvesting in Newport Bay, Work Plan", dated March 1, 2001.
6. Staff reviewed this proposed work plan and found it generally acceptable. However, staff identified some additional comments and recommendations concerning the study design that needed to be addressed before staff could recommend approval of the work plan. These comments/recommendations were discussed with OCPF&RD staff and appropriate revisions to the work plan were submitted.
7. OCPF&RD requested that the time for completion of the assessment be extended from 13 months to 24 months. Such an extension is reasonable given the comprehensive nature of the shellfish harvesting beneficial use assessment.

NOW, THEREFORE, BE IT RESOLVED THAT:

The Regional Board approves the "Beneficial Use Assessment for Shellfish Harvesting in Newport Bay, Work Plan" dated March 1, 2001, as amended by OCPF&RD. The assessment shall be completed no later than April 1, 2003.

I, Gerard J. Thibeault, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Santa Ana Region, on April 19, 2001.

Gerard J. Thibeault
Executive Officer

The other attachment to the staff report ("Attachment to Resolution 99-10") is the fecal coliform Total Maximum Daily Load (TMDL), which is available on our web site at:

<http://www.swrcb.ca.gov/~rwqcb8/html/tmdls.html>

"Attachment to Resolution 99-10"

**Beneficial Use Assessment for Shellfish
Harvesting In Newport Bay**

Work Plan

March 1, 2001

Prepared and submitted on behalf of:

The County of Orange
and
The Cities of Irvine, Tustin, Newport Beach,
Lake Forest, Santa Ana, Orange and Costa Mesa
and The Irvine Company

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Beneficial Use Assessment for Shellfish Harvesting in Newport Bay Watershed

1. Rationale

The California Regional Water Quality Control Board, Santa Ana Region (RWQCB), has identified the Lower and Upper Newport Bay as a water quality limited receiving water body which indicates that applicable water quality standards (beneficial uses and objectives) are not being attained, or expected to be attained, with the implementation of technology-based controls. Lower and Upper Newport Bay receiving waters are also included on the 1998 California 303(d) List. The 303(d) List identifies pathogens (and other pollutants) as stressors of water quality and indicates that urban runoff/storm sewers are the source of the pathogens. The RWQCB has indicated that bacterial contamination has resulted in a shellfish harvesting (SHEL) and a water contact recreation (REC-1) ban in some areas of the Newport Bay Watershed.

The State Water Resources Control Board, per the requirements of Section 303(d) and consistent with the California 303(d) List, approved on December 31, 1999, the Total Maximum Daily Load (TMDL) for fecal coliform bacteria in the Newport Bay Watershed. The TMDL is a prioritized, phased approach to the control of bacterial quality in the Bay. Waste Load Allocations (WLAs) and Load Allocations (LAs) are established in the TMDL to assure compliance with water contact recreation and shellfish standards. The TMDL is to be adjusted, as appropriate, based upon completion of specified studies. The results of the studies may lead to recommendations for changes to the TMDL to assure compliance with existing Basin Plan standards and/or for changes to the Basin Plan objectives and/or beneficial uses. Revision of the TMDL, if appropriate, would also be considered through the Basin Plan amendment process.

Work carried out to address the fecal coliform TMDL focuses on developing sufficient information for the RWQCB to balance the benefits and costs associated with ensuring the reasonable protection of beneficial uses. To date, work has focused on developing such information for water contact recreation in Newport Bay. This work has been carried out in a collaborative manner by local municipal stakeholders, the RWQCB, the Orange County Health Care Agency (HCA), and Irvine Ranch Water District (IRWD) and its consultants, EOA, Inc. and Resource Management Associates (RMA). The next step in the phased TMDL process is to address the TMDL requirements (Table 5-9g of RWQCB Resolution No.99-10) to assess shellfishing as an existing and potential beneficial use.

2. Objectives

The primary objectives of this investigation are as follows:

1. To identify historic areas of bivalve mollusk shellfishing (shellfishing) in Newport Bay and to document the degree of the beneficial use;
2. To establish the existing level of the shellfishing resource in Newport Bay;
3. To characterize current levels of shellfish collection (for consumption and bait) as a beneficial use in Newport Bay;

4. To investigate impediments to, and the possibility of enhancing, the potential for increased levels of shellfish collection in Newport Bay; and
5. To document the results of the investigation in a manner that will be useful to the Santa Ana RWQCB for decision-making purposes.

3. Research Approach

3.1 Task 1: Literature Review

The primary objectives of this task are to identify areas in Newport Bay where shellfishing historically occurred, to document the levels of that beneficial use, and to identify environmental or other changes that occurred which resulted in changes in the level of shellfishing.

Historically (prior to the 1940's) Newport Bay was much less urbanized and more open to the ocean than it is currently, and shellfishing, including oyster fishing, occurred on a commercial basis in Upper Newport Bay. Between that time and the present, sport shellfishing has occurred on a regular or sporadic basis. It has been suggested that habitat changes resulting from increased urbanization around Newport Bay caused a gradual decrease in the shellfish resource between the mid-1930s and the present. It has also been hypothesized that the 1969 flood caused irreparable changes to the shellfish habitat. One possibility is that the flood caused the dyke maintained by the salt works to break, thereby increasing sediment loading to the bay and impacting the shellfish habitat. This task will seek to identify and document specific changes that occurred in or around the Bay to determine if, when, and/or why historical levels of shellfishing declined. A secondary goal of this task will be to determine if documentation exists to identify sites in Lower Newport Bay in which shellfishing occurred in the past, or is currently practiced. Finally, this task will characterize the physical attributes of locations within the Newport Bay area where shellfishing is most likely to be supported.

A number of primary resources will be utilized in this task. Some of those resources are located in University of California libraries at Irvine and Riverside, California State University libraries at Fullerton and Long Beach, and the Santa Ana RWQCB library. Other resources include data from investigations carried out by the Orange County Health Care Agency (1976 Newport Bay Watershed Study and others), benthic studies conducted by Irvine Ranch Water District, California Department of Fish and Game investigations, and other special studies, including related environmental impact reports and statements.

Product: A technical memorandum which identifies areas in Newport Bay where shellfishing historically occurred, documents historical levels of the beneficial use, and identifies environmental or other changes that occurred which resulted in changes in the level of shellfishing.

3.2 Task 2: Resource Survey

The purpose of this task will be to conduct a census to determine the types, sizes, and abundance of different shellfish within the intertidal zone of Upper and Lower Newport Bay. The census will focus on the bivalve shellfish that are used, or may potentially be used, for sports harvesting. This task will be carried out in a manner consistent with the San Francisco RWQCB's San

Francisco Bay Shellfish Program of the late 1970s and 1980s (CA RWQCB 1983a,b, 1981, 1980; CA DFG 1982; USPHS 1979; Cooper et al., 1981).

This task will include two phases. The first phase will consist of a qualitative reconnaissance survey of the entire Lower and Upper Newport Bay intertidal area to identify locations where a more detailed quantitative survey of shellfish populations is warranted. The reconnaissance survey will include visiting the entire Bay shoreline at (approximately) low tide. This reconnaissance will be carried out on foot by qualified professional staff, to identify where populations of shellfish are located and to note factors that may limit the distribution and abundance of shellfish at each of the locations (including areas of potential use that are not now used due to postings or limited access). The reconnaissance may be limited in areas where access is restricted (fences, cliffs, etc.), by access to private property, by mud and other natural impediments, and other unidentified conditions. Information on the type of substrate, shellfish observed, and any people collecting shellfish for bait or food will be recorded and pictures taken. Areas where mussels are growing on pilings and other hard surfaces will also be recorded. Particular attention should be paid to the following potential shellfish locations, which the California Department of Fish and Game has identified as easily accessible and used by fishermen:

- Back Bay road south of Big Canyon;
- Back Bay road north of Big Canyon;
- Jamboree Bridge;
- Northstar beach;
- Back Bay drive narrows; and
- 72nd place

Local Fish and Game representatives and game wardens will be contacted at the onset of the investigation to confirm the previous locations and to determine the location of any other potential shellfish collection sites.

Based on the reconnaissance survey, the second phase will consist of surveying shellfish beds or mussel growing areas in order to develop quantitative estimates of shellfish abundance and sizes for each species of shellfish encountered. Shellfish beds to be investigated will be determined based on the reconnaissance survey, and will include shellfish beds in both Lower and Upper Newport Bay. The methods used to determine the abundance of shellfish will be equivalent to the procedures used by the California Department of Fish and Game in estimating bivalve shellfish abundance in portions of San Francisco Bay (California Department of Fish and Game, 1982). A summary of those methods follows.

Transects and Quadrats

The method used will include establishing parallel transects every 200 feet along the shoreline within the bivalve bed being surveyed. Every ten feet along these transects an approximately one-square foot area will be measured using a quadrat. The transects will extend from the uppermost zone of bivalve habitat down to the water line or end of typical bivalve habitat.

Within each established quadrat, a small hand pick and/or three-tined garden cultivator will be used to dig clams. The cultivator is generally more suitable for rocky substrates. For any quadrats that land on hard surfaces that have mussels, no digging would be required.

The depth of the area excavated beneath each quadrat will be as deep as needed to collect any bivalves present, which is expected to be within a few inches of the surface and unlikely to extend deeper than about one foot, depending on the species and size of shellfish present. The sediment composition of each quadrat will be recorded.

Sorting and Collecting

All bivalves removed from the quadrat will be placed in a plastic collander to be washed and measured. The Department of Fish and Game found that using this method most of the bivalves will be identified, but some will be missed, especially those under about 5 mm. Bivalves will be individually identified, measured in the field to the nearest mm using steel calipers, and replaced in the field. For hard surfaces with mussels, all of the mussels will be removed from the quadrat, counted and measured.

The shellfish beds will be prioritized for quantitative surveying based on the apparent total population of the bivalve bed, the existing use and the accessibility of the bed. If there are ten or fewer bivalve beds, all of the bivalve beds will be surveyed. If there are more than ten bivalve beds, the highest priority five bivalve beds will be quantitatively surveyed and ten percent of the other bivalve beds (not to exceed five additional beds), selected at random, will be surveyed. Small species of bivalves that are not used for bait or human consumption do not need to be included in the quantitative survey, but should be identified as occurring in the area surveyed. Similar to the reconnaissance survey, any observations of people collecting shellfish will be recorded. Information on the types and numbers of shellfish being collected and how they are being used will be determined, if possible.

Products: A technical memorandum will be prepared documenting the materials and methods used to conduct the census, as well as information about the locations of shellfish beds, and estimates of shellfish abundance. Shellfish abundance will be estimated for each shellfish species within the entire Bay and for each of the shellfish beds that received a quantitative survey. Information on the sizes of shellfish for each species will also be tabulated. All information collected during the census on the human use of the shellfish for bait or food will also be documented and described. This report will also include an assessment about the factors that appear to be limiting the distribution and abundance of shellfish. This assessment will be based on the completed fieldwork and professional judgment for use in helping to direct Task 4's more detailed evaluation of the impediments to reestablishing shellfish populations.

3.3 Task 3: Beneficial Use Assessment – Shellfish Harvesting

The purpose of this task is to characterize current levels of shellfish collection (for consumption and bait) as a beneficial use in Newport Bay. The results from Tasks 1 and 2 will be used to focus the scope of this task (i.e. the use assessment will focus only on physical areas where shellfish are/have been collected). Data for this task will need to be collected over

approximately a twelve month period covering both dry (April through October) and wet (November through March) seasons.

The strategy employed in this task will be to identify where and when shellfish are being collected in Newport Bay, and then to quantitatively estimate the level of shellfish collection occurring in Newport Bay. The work to be carried out for this task will be divided into the following subtasks:

3.3.1 Task 3.1: Beneficial Use Site Validation

The first component of work to be carried out in this task will be to validate that shellfish are being collected at the sites identified in Tasks 1 and 2. Based on preliminary information from the Department of Fish and Game, it is anticipated that the sites shown below may be included in this task. Those sites may be augmented and modified based on the results of Tasks 1 and 2, as appropriate. If it is determined in the second phase of Task 2 that any of the investigated sites contain levels of shellfish such that a majority of the samples have no consumable shellfish, that site will not be investigated further in this task.

- Back Bay road south of Big Canyon;
- Back Bay road north of Big Canyon;
- Jamboree Bridge;
- Northstar beach;
- Back Bay drive narrows; and
- 72nd place.

An intensive two-week monitoring program will be carried out to determine if shellfishing is occurring at the specified locations. Monitoring for shellfishing activity will be carried out at each site during daylight hours from 1.5 hours prior to low tide to 1.5 hours post low tide. The goal of this screening-level effort will be to document the number of individuals collecting shellfish (or apparently attempting to collect shellfish) at each of the sites during the specified time frame.

3.3.2 Task 3.2: Design Exposure Data Collection Plan

Based on the results of Task 3.1, an experimental design will be devised to collect use assessment data for shellfishing activities (how many people engage in shellfishing activities, when, and where). A purposeful sampling program and user survey will be designed to estimate the number of individuals collecting shellfish at each of the specified sites and to characterize the percent of people collecting shellfish for bait versus for consumption. Based on information available (Fish and Game and/or game warden data or observations, etc.), a power analysis will be conducted to determine the number of sampling days required to generate the estimates described above.

In a similar use assessment conducted to characterize the REC-1 beneficial use in Newport Bay, use data were collected on a total of 35 days over a 12 month time period. It is anticipated that a similar level of effort may be required to characterize the level of shellfishing as a beneficial use

in Newport Bay. To eliminate bias in the experimental design a randomized sampling protocol will be used to identify the days in which monitoring is to be carried out. The experimental design will be employed so that both weekends and weekdays are included, and both wet and dry seasons are included. On each day in which monitoring occurs, (recording the number of people collecting shellfish), the monitoring data will be collected within 1.5 hours of low tide. A user survey will be designed to identify whether shellfish are collected for consumption or bait. The survey may also include other relevant questions, and will be administered to all shellfishing participants noted at each of the sites on each of the days in which monitoring occurs.

3.3.3 Task 3.3: Data Collection

The purpose of this task will be to collect the data specified in Task 3.2. Actual collection of data will likely be carried out by an interns, student researchers, and/or professional staff.

3.3.4 Task 3.4: Data Reduction and Interpretation

The purpose of this task is to analyze the results of Tasks 3.1 through 3.3 and summarize those results in a technical memorandum which will provide documentation of 1) the existing level of shellfish collection as a beneficial use in Newport Bay, and 2) characterize the relative levels of that use that are carried out for bait collection versus consumption purposes.

Product: Technical memorandum documenting the existing level of shellfish collection as a beneficial use in Newport Bay and characterizing the relative levels of that use for bait collection versus consumption purposes.

3.4 Task 4: Investigation of Beneficial Use Enhancement

The purpose of this task is to investigate impediments to, and the possibility of enhancing, the potential for increased levels of shellfish collection in Newport Bay. Results from Task 2 (Resource Survey) will be used as inputs for this task. To carry out this task, work has been subdivided into three subtasks.

3.4.1 Task 4.1: Screening Level Monitoring Investigation

A screening-level monitoring investigation will be carried out to determine if there are any water quality constituents that may be limiting the potential for increased levels of shellfish in known (current and/or historical) shellfish beds in Newport Bay. The monitoring will be carried out to include both wet and dry seasons, and will include screening-level monitoring for such constituents as salinity, dissolved oxygen, toxicity, ammonia, metals, organic compounds, pesticides, and bacterial indicator organisms. Historical data in surrounding areas will be investigated and incorporated, where appropriate, with the results of this subtask.

Sites to be monitored will be identified based on the results of Tasks 1 and 2. Sites to be considered for this task will include 1) historical sites that no longer support shellfish populations, 2) sites with physical characteristics that appear to be able to support shellfish populations but do not; 3) sites with unhealthy or sparse shellfish populations, or low diversity;

4) sites identified in task 2 as potential sites; and 5) others identified during Tasks 1 and 2. It is anticipated that approximately 3-4 sites will be monitored monthly for constituents such as those identified above, over the course of approximately 4-5 months.

3.4.2 Task 4.2: Pilot Scale Investigation to Test Suitability of Substrate

A small pilot-scale investigation will be carried out to determine the suitability of the substrate in Newport Bay for enhanced abundance levels of mussels and clams. The purpose of this subtask is to determine whether or not the substrate is the critical item limiting the current numbers of shellfish in existing Newport Bay shellfish beds. To carry out this investigation, a small scale experiment will be designed and implemented in coordination with the California Department of Fish and Game and the Upper Newport Bay Ecological Reserve. In this investigation, several of the species identified in Task 2 will be grown and monitored in Newport Bay under controlled conditions.

It is anticipated that this subtask will be carried out over a six month time frame at two sites to be identified within Newport Bay. At each location, two- 1 square meter test areas will be used to grow ~100 small clams (the exact species will be identified at a later date). In one of the test areas, the existing Newport Bay substrate will be used, in the other, an substrate considered to be excellent for the species (to be identified) will be used as a control. Clams will be monitored from each of the (4) test areas at 2,4, and 6 months for viability, size, and weight. The results of this task will be used to determine whether or not Newport Bay substrate may be suitable for enhanced levels of mussels and clams.

3.4.3 Task 4.3: Potential Impact of Environmental Controls

The goal of this subtask is to investigate whether environmental controls have the potential to facilitate increased levels of shellfish growth and collection in Newport Bay. This task will be carried out by taking advantage of an existing water quality model of Newport Bay, and extending the model as needed to investigate the impacts of a series of potential environmental controls on shellfish habitat.

An existing water quality model of Newport Bay developed by RMA was originally configured (in two dimensions) for hydrodynamic, sediment transport, and salinity simulation in support of the U.S. Army Corps of Engineers Feasibility Study. The model is currently being extended for:

1. Simulation of basic water quality parameters (i.e. temperature, dissolved oxygen, nutrients, and phytoplankton) with the support of the California State Water Resources Control Board;
2. Simulation of coliform and coliphage, supported by WERF funding as one component of the fecal coliform TMDL investigation; and
3. Simulation for salinity in 3-D to determine under what flow regimes stratification is important. This work is also being supported by the California State Water Resources Control Board.

The RMA model uses a finite element numerical method that permits explicit representation of the complex shape of Newport Bay, and is well-suited to simulation of shallow estuaries where large areas of mudflats are exposed at low tide. The RMA models support one, two, and three-dimensional elements in a single computational network; however, because the emphasis has been on the shallow Upper Bay, the bulk of the simulations to date have used a two-dimensional depth-averaged approximation. Calibration of the salinity model has demonstrated that the two-dimensional depth-averaged approximations are reasonable in the Upper Bay during much of the year. During and immediately after storm events, however, stratifications may be important in the Upper Bay.

Simulation of hydrodynamics, sediment transport, and water quality is intertidal with time steps on the order of five to 15 minutes. Due to the complexity of the finite element mesh, to date it has not been feasible to perform continuous long-term simulations.

The first step will be to determine whether the existing two-dimensional depth-averaged model of the Bay will be sufficient for the purposes of this task. That determination may be a point of discussion once sufficient data have been collected in the previously described tasks and related water quality modeling work is complete. Once that determination is made, a series of potential environmental controls will be identified. Examples of environmental controls that may be considered include dry season storm drain diversion, public education campaigns to reduce non-point source pollution such as not feeding ducks near shellfish beds, minimizing pet waste, and/or minimizing vessel waste, and other factors identified in this investigation. The potential controls to be investigated will be identified with input from local stakeholders, the RWQCB, the Orange County Health Care Agency, and others. A series of three to five simulations will then be carried out to determine if the implementation of those controls would positively impact the shellfish habitat.

Product: Technical memorandum describing the results of the screening-level monitoring investigation, the pilot scale substrate investigation, and the water quality model simulations.

3.5 Task 5: Final Report

The purpose of this task is to document the results of the investigation. The investigation's final report will contain a compilation, summary, and interpretation of all of the data and information gathered during the course of the investigation.

Product: Semi-annual status reports will be submitted summarizing the progress of the investigation. A Final Draft report will be prepared and submitted for review. Upon receipt of comments, the Final Draft report will be edited and modified as appropriate, and a Final Project report will be submitted.

4. Quality Assurance/Quality Control

4.1 Data Acquisition

As described in Section 3 of this proposal, data acquisition in this investigation will include the following:

1. Gathering and summarizing relevant existing data to document the historical level of shellfish collection as a beneficial use in Newport Bay;
2. Collection of data to document the existing resource of shellfish in Newport Bay;
3. Collection of data to document the existing level of shellfish collection as a beneficial use; and
4. Collection of data to document potential enhancement sites.

4.2 Assessment/Oversight

Assessment and oversight will be provided by a review committee convened by the National Water Research Institute and by the local stakeholders. The review committee and local stakeholders will provide feedback and technical guidance to the investigators as appropriate. The review committee will also provide independent quality control over reports, recommendations, and conclusions

4.3 Data Validation and Usability

Data validation and usability will be confirmed by the review committee as part of the independent quality control assessment and oversight. Local stakeholders involved in the project will also provide feedback in this respect, as appropriate. If questions arise during the course of the investigation in terms of the validity or usability of the data, the review committee will be consulted in writing and will be asked for feedback.